I, I fear, can speak most authoritatively of the accuracy of Semper's statement: "An Spirituspräparaten ist so gut wie Nichts von ihrem feineren Bau zu erkennen" [1].

Finally, as to the systematic value of the Cuvierian organs we must, I think, agree with Semper that they are "viel weniger characteristicsh in ihren Formen für die einzelnen Gattungen, als es nach Müller's Arbeiten scheinen könnte." At any rate, in no other organ does *H. nigra* display any character or combination of characters which would lead us to separate it off from the rest of the true Holothuriæ.

The five specimens in the British Museum were obtained off the coast of Cornwall; two are said to have been "taken about some crab-pots, at a depth of 20 fms. Polperro."

4. On Races and Hybrids among the Salmonidæ.—Part II. By Francis Day, F.Z.S.

[Received May 19, 1884.]

On January 15th of this year (see P. Z. S. 1884, p. 17) I gave an account of the continuation of some experiments made by Sir J. Gibson-Maitland, F.Z.S., on the breeding and hybridization of Salmonidæ at Howietoun, and the inception of a few new ones. I propose in this paper to briefly remark upon their continuation, and how matters stood on March 13th, 1884.

First, as to the hybrids between Salmon and Lochleven Trout. The oldest batch of these hybrids are the descendants from 20,000 eggs of the Trout milted from *Salmo salar* December 24, 1881, and which up to March 13, 1884, had been kept in a planked pond, 20 feet long by 5 feet wide. On this date those which remained (numbering 212), all of which appeared to be in perfect health, were removed to the octagon pond at Craigend. Among them, six were over 10 inches in length, but the majority were smaller, and some not above $2\frac{1}{2}$ inches, showing the great range of variation in size of young Salmonidæ raised from eggs and milt obtained at one time from the same parents although the resulting offspring are kept under exactly similar conditions of existence.

I remarked in the paper referred to, that on Nov. 29, 1883, 4500 eggs of the Lochleven Trout (of the season of 1875) were milted from the parr of a Salmon raised at Howietoun [2], and the eggs were placed in hatching-box No. 88. The number of eggs removed as dead during the following months were as follows:—in December

[1] I have carefully compared M. Jourdan's account of the Cuvierian organs with the interesting account given by my friend Mr. J. E. Blomfield (Q. J. M. S. xxii. p. 355) of the thread-cells of *Myxine*, but I cannot detect any points of similarity. Perhaps M. Jourdan will, in the further investigations which he has promised to make, direct especial attention to Mr. Blomfield's account of *Myxine*.

[2] An error appears in my former paper, at page 19, these fish having been hatched in March 1881, not 1882.

65, in January 18, and in February 4, or a total of 87 deaths, while an additional 199 eggs were found not to have been originally impregnated. From the foregoing experiment we can draw the conclusion that the mortality was only 1 in 46 eggs, when those of mature Lochleven Trout were milted from immature Salmon-parr.

But although this mortality was only slightly in excess of 2 per cent. of the eggs, such by no means gives a true index to the result of the experiment, for it was soon perceived that the milt of the parr (at least in this instance) was insufficient to satisfactorily impregnate the eggs of the Trout, in order to raise a strong and vigorous brood of alevins, while weak ones are useless for stocking purposes, even should they overcome the diseases and dangers of their youth.

On February 15, 1884, some thousands were hatched from these eggs, but nearly all were seen to be suffering from what has been termed dropsy, or blue swelling of the yelk-sac. This non-contagious disease, as observed by Livingston Stone, is one for which no remedy is known, and concerning which he remarks no cause for its origin had been ascertained. Appearances led me to the belief that in this instance such must have been due to insufficient vitality in the young, a consequence of the imperfect fecundating power of the milt. In that such cannot be due to simply crossing these two forms, is evident from the 212 examples of hybrids between the male Salmon and female Lochleven Trout, and which are now in the octagon pond at Craigend, as I have observed upon.

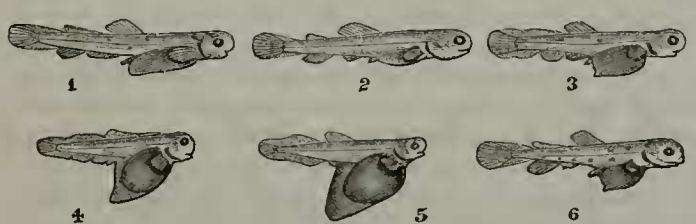

Fig. 1. *Salmo levenensis*, 29 days old.
Fig. 2. —— ——, 43 days old.
Fig. 3. —— *fontinalis* ♂, *Salmo levenensis* ♀, 27 days old.
Fig. 4. —— *salar* ♂, *Salmo levenensis* ♀, 27 days old.
Fig. 5. —— ——, —— ——, 41 days old.
Fig. 6. —— ——, —— ——, 91 days old.

March 12, 1884, I first saw these young fish, then almost one month old, and their average length being 0·8 of an inch ; but what at once struck an observer was the large and pyriform umbilical sac, which seemed to anchor them to the bottom of the tank ; some were thus seen singly, others in groups, while every now and then one would start up and swim a short distance in an irregular or spasmodic manner, and then subside to the bottom. This dropsical enlargement in a considerable proportion of the fish was 0·35 of an inch in length, and 0·2 of an inch in diameter where it was widest, while it stood out in tolerable relief from the enclosed yellow yelk-

sac, showing the existence of two coats, separated one from another by an accumulation of clear fluid. Under a strong glass there appeared to be a want of vitality in the fish, the pulsations being feeble, the activity of the heart being less than in more healthy forms, and a deficiency of red corpuscles in the blood. Due to this dropsical distension, the pectoral fins were much impeded in their movements, which is very material, because in the young fish these fins are in constant motion, in order by keeping up a continuous current to help the gill-covers in aerating the blood at the gills, for the gills at this early period of life are partially uncovered, although not free as seen in fœtal plagiostomes.

Another experiment made at the same time leads to a corroboration of my belief that the milt of these young Salmon-parr is deficient in marital powers, for, as I previously remarked, 1000 eggs of the common Brook-trout were milted from one of these Salmon-parr which had been dead a few hours. The result in this instance has been that not one single egg was fructified. Only 3 eggs turned white in December, 3 in January, and 15 in February, or a total of 21 ; and on March 12 the remainder were still quite clear, but without a sign of an embryo within.

It has been remarked at Howietoun, that eggs from young mothers are subject to a greater percentage of deaths than those taken from older fish, and this raises the conjecture that, similarly, the marital power of milt from young males may possess less fertilizing properties than that obtained from older parents.

On March 26, Sir J. Gibson-Maitland sent me specimens of these hybrids, the largest of which was 0·7 inch in length, and the comparative size of the dropsical swelling, as may be seen from the diagrams on the wall, or the examples on the table, had considerably augmented in size. From this period these fish commenced dying off, and by May 15 none of those which suffered severely with dropsy were left, but about 400 that from the first had not been so weakly as the others. One of these I received alive from Howietoun, sent in a small glass bottle of water (containing rather less than half an ounce) through the post ; after arrival it lived 43 hours in a tumbler. Its length was 0·8 of an inch, or the same as was the average of those I measured on March 12, when nearly one month old : the specimen is on the table.

The other experiments I will now briefly chronicle. On November 29, 1883, 3695 (formerly printed 2695) eggs of *Salmo fontinalis* were milted from a parr of *Salmo salar*. In December, 144 dead eggs were removed, during January 1527, and in February 401, or a total loss of 3372 ova. On March 12, 1884, 7 were alive, but not in a satisfactory condition.

On November 15, 1882, 2000 ova from a Lochleven Trout were milted from a *Salmo fontinalis* ; on November 29, 1883, 150 were estimated to be alive, but this must have been too low a number—250 seems to be more probably nearer the mark. These have been kept in a large wooden box, rather exposed to the east, but still had done comparatively well up to this time. On this day, March 12,

1882, upwards of 20 were found to be dead, so the next day they were removed to the upper pond at Howietoun, into which 211 were placed; some, however, seemed to be very weakly. In three of these fish a remarkable change had occurred as to the colour of their fins, the ventral, anal, and caudal having become of a carmine-red. One, which was $2\frac{1}{2}$ inches long, happening to die, I found that its left eye had never been developed, while there were adhesions between the iris and subjacent structures in the left eye. The longest fish was a little over $3\frac{1}{4}$ inches in length.

On November 29, 1883, 3000 ova were taken from a Lochleven Trout of the season of 1875, and milted from a *Salmo fontinalis*. The number of dead eggs removed were as follows:—80 in December, 56 in January, 25 in February, or a total loss of 161; while 296 were found not to have been impregnated, or a proportion of 1 death in 17 ova. These young fishes were far more advanced than the dropsical forms previously alluded to.

On November 15, 1882, 8000 ova of *S. fontinalis* were fecundated with milt from a Lochleven Trout, and on November 29, 1883, only 16 were alive. They were kept under the same conditions as the last, and on March 13, 1884, only 8 were remaining, and these in an unsatisfactory condition. They were removed to Howietoun planked pond on that day.

On November 12, 1883, some eggs from *S. fontinalis* were milted from a Scotch trout; and in November 28, in December 193, and in January 1028, or a total of 1449 dead ova were removed. On March 13, 1884, there appeared to be about 500 young fish doing well.

On November 15, 1882, 9000 ova of *S. fontinalis* were milted from a Scotch Charr, *S. alpinus* var. *struanensis*, and no monstrosities as observed among the other crosses resulted. On March 13, 1884, 91 lively young fish were transferred to No. 1 upper planked pond at Howietoun.

On December 1, 1883, some American Charr-eggs were milted from a Scotch Charr, and the following is the monthly record of the mortality:—January 138, February 787, March 194, or a total of 1119. On March 13, 1884, upwards of 100 young were present.

I shall defer making any remarks on the foregoing simple statement of results until the experiments have been further developed by time; but I cannot resist calling attention to the following point, as it seems desirable that information on such should be obtained from the widest sources.

If hybrid Salmonidæ are to be worth rearing, of course the fish-culturist would desire to obtain the finest breed; and the first subject that deserves inquiry is whether the species among vertebrate animals which forms the male or the female parent exercises any peculiar modifying influence on the size of the offspring. Dr. Gray remarked that among hybrids the offspring attained to the size of the largest parent; but he does not appear to have considered that it was of any consequence whether this larger parent should have been the male or the female, and if it is, such a point is most desirable

to ascertain as bearing on the crossing of Salmon and Trout. When we examine the lower animals we are told that should we cross the female Ass with the Horse stallion we obtain a *hinny*, in which the head is like that of the father, the ears those of the Horse, as is also the neigh, the size following the female. If, on the other hand, we take a Mare, and cross it with an Ass, we obtain a *mule*, wherein the head is asinine, with long ears, &c., while it brays, and here likewise size may be said to follow the mother. I have been examining some interesting crosses among Pheasants at Col. Smyth's; he has crossed the male Amherst with the female Golden Pheasant, and the head of the young is unmistakably that of the Amherst. He reversed the experiment, the Golden Pheasant being the father, and the head and the generality of the plumage certainly takes after the father. I have seen some other instances which would seem to follow the same course, wherein the male appears to have had the largest share in the production of the appearance of the offspring; but I have likewise been shown an instance in which the species of the mother appears to have had the greatest proportion in the plumage of the young.

I simply draw attention to this question as one which may or may not have any modifying influence on the offspring, and to ask those who may be in positions to observe any results which ensue, to kindly note them down for future information.

The experiment with the young Trout reared from the parents of 1875 or 1876 continues to afford the same results as formerly noticed, young reared from the larger eggs giving the finest offspring. The fish in both ponds have grown considerably during the winter months.

Respecting the young Canadian Salmonidæ hatched at the Fisheries Exhibition by Mr. Wilmot on and after May 1, 1883, a considerable number are still alive. I went carefully through them April 24, 1884, when they were not a year old. Many were in their parr livery, and merely 2 to $2\frac{1}{2}$ inches long, and from this all intermediate lengths were present up to a batch of 10 fry which were kept in a tank by themselves, and had attained from $5\frac{1}{2}$ to 6 inches in length. Two of these last were perfectly silvery smolts, destitute of any finger-marks, while in the other eight faint vertical bands were visible, while none had any red spots. The fins were very dark, and there were numerous black spots over the upper half of the body. On May 5 I found these smolts were becoming very restless, and although in some the lateral bands were visible, they were very faint. The colour of the body from the adipose dorsal (or in some from just posterior to the rayed dorsal) to the caudal fin had become very black, while if anything all the fins appeared to be darker.